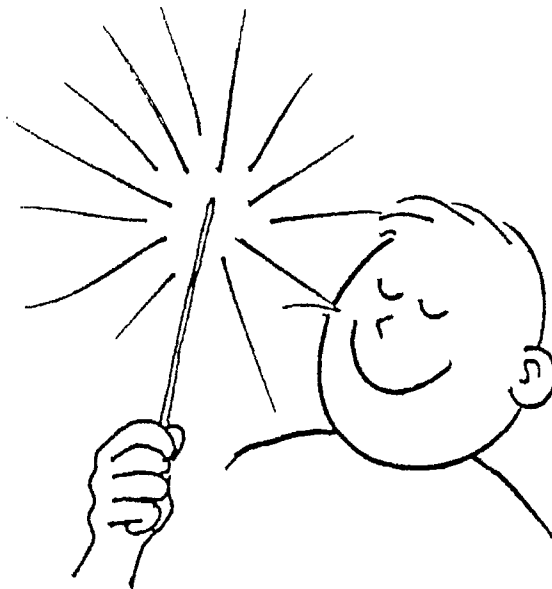


NEXT-TIME QUESTION



TOUCH THE INSIDE OF A 200°C HOT OVEN AND YOU BURN YOURSELF. BUT WHEN THE 1800°C WHITE HOT SPARKS FROM A 4TH-OF-JULY TYPE SPARKLER HIT YOUR SKIN, YOU'RE OKAY. WHY?

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Answer

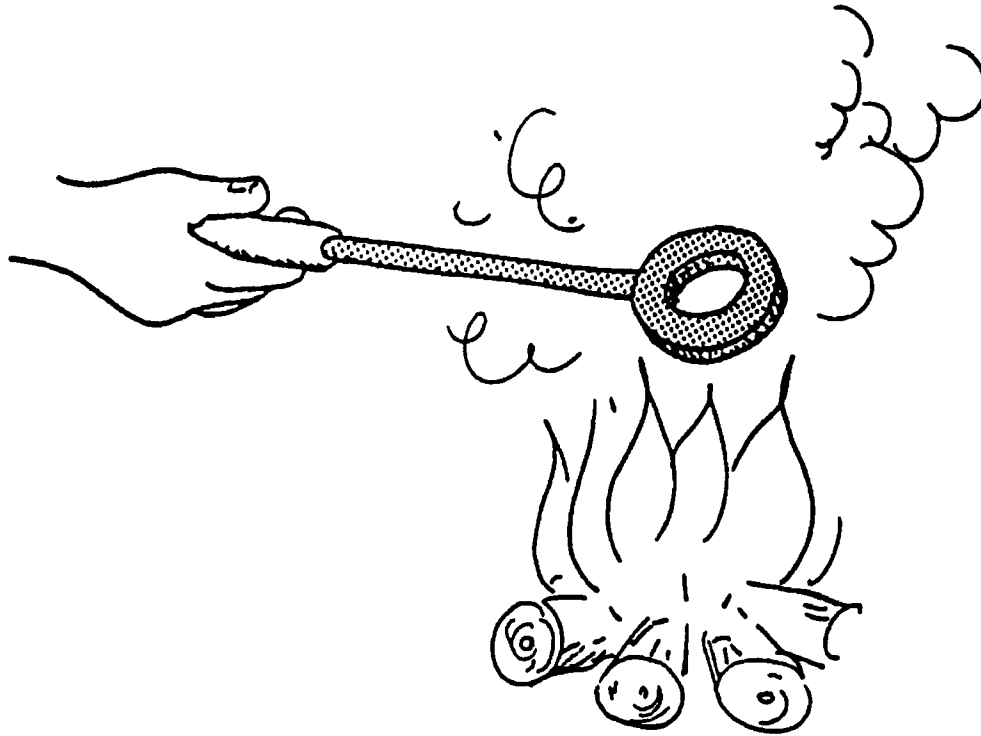
Temperature is proportional to energy per molecule. How much energy depends on how many molecules. When you touch the inside surface of the oven, you're making contact with many, many molecules, and the flow of energy is a painful experience. Although the energy per molecule is much greater in the sparks of the firework, you make contact with only a relatively few molecules when a spark lands on you. The corresponding low energy transfer borders on your threshold of feeling.

High temperature at low energy is like high voltage at low energy. Both a high-temperature spark and the high voltage of a charged balloon are harmless because their energies are very small.



Hewitt
draw it!

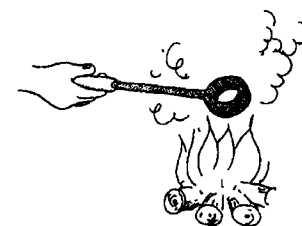
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WHEN THE TEMPERATURE OF A METAL RING INCREASES, DOES THE HOLE BECOME LARGER? SMALLER? OR REMAIN THE SAME SIZE?

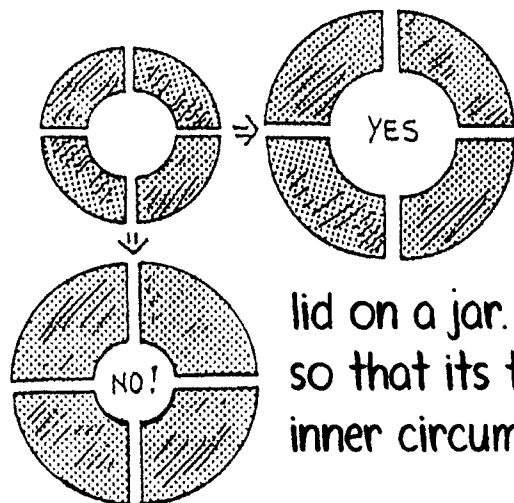
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Answer: larger

When the temperature increases, the metal expands—in all directions. It gets thicker; its inner as well as its outer diameter increases; every part of it increases by the same proportion. To better see this, pretend that the ring is cut in four



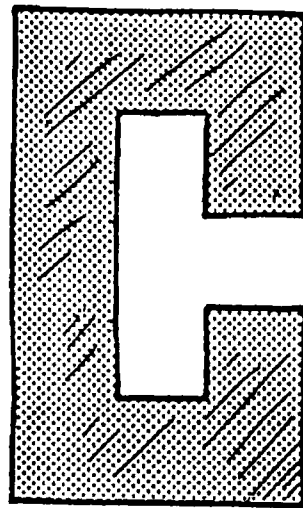
pieces before being heated. When heated they all expand. Can you see when they are reassembled that the hole is larger?

Test this yourself the next time you can't open the metal lid on a jar. Heat the lid by placing it over a hot stove or under hot water so that its temperature momentarily increases more than the glass jar. Its inner circumference will increase and you'll easily unscrew the lid!

Hewitt
Hewitt!

Next-Time Question

WHEN THE TEMPERATURE OF THE PIECE OF METAL IS INCREASED AND THE METAL EXPANDS, WILL THE GAP BETWEEN THE ENDS BECOME NARROWER, OR WIDER, OR REMAIN UNCHANGED?



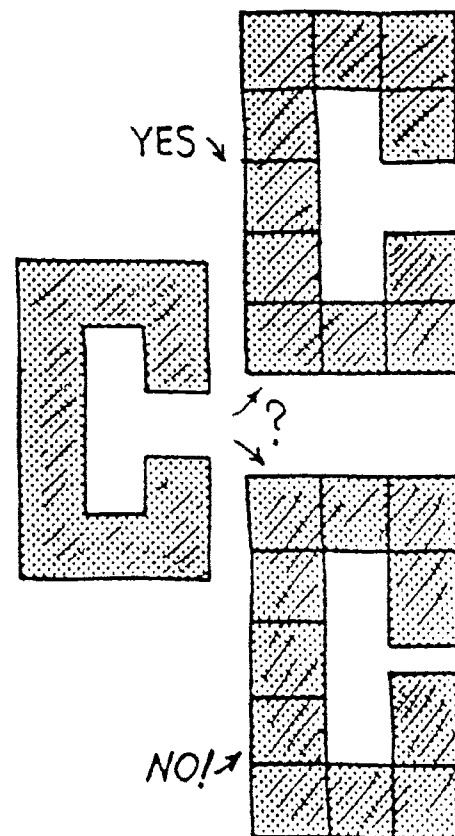
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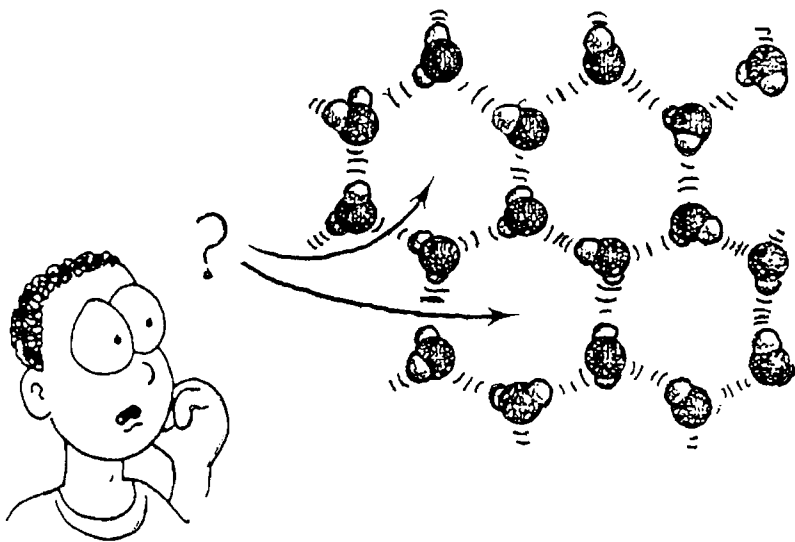
Answer: wider

The gap will become wider when the metal expands. To see this, pretend the shape is composed of little blocks, each the size of the gap. When heated, each block expands the same. So if the metal is heated uniformly, every part expands at the same rate—even the gap.



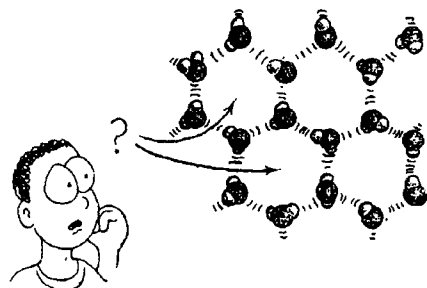
Next-Time Question

WATER MOLECULES IN ICE LINK TOGETHER TO FORM AN OPEN-SPACED STRUCTURE. THE OPEN POCKETS IN THE STRUCTURE ARE WHAT MAKES ICE LESS DENSE THAN WATER, WHICH IS WHY ICE FLOATS ON WATER. TO BE SURE YOU INTERPRET THIS CORRECTLY, ANSWER THIS: WHAT'S INSIDE THE OPEN POCKETS?



- a) AIR
- b) WATER VAPOR
- c) NOTHING

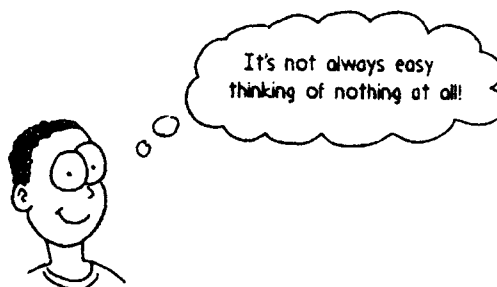
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a) AIR b) WATER VAPOR c) NOTHING

Answer: c

If there were air in the open spaces, the illustration would have to show the molecules of air, such as O_2 and N_2 , which are comparable in size to water molecules. Any water vapor would be seen as unassociated water molecules spaced relatively far apart. Neither of these are shown in the illustration. Instead, the open pockets represent nothing but empty space — void.



Hewitt
Draw it!